DOCUMENT RESUME

ED 454 774 HE 034 131

AUTHOR	Lachler, Ulrich
TITLE	Education and Earnings Inequality in Mexico. Policy Research Working Papers.
INSTITUTION	World Bank, Washington, DC.
REPORT NO	WB-PRWP-1949
PUB DATE	1998-07-00
NOTE	30p.
AVAILABLE FROM	World Bank, 1818 H Street, N.W., Washington, DC 20433. Tel: 202-473-7776. For full text: http://wbln0018.worldbank.org.
PUB TYPE	Reports - Evaluative (142)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Education Work Relationship; *Educational Attainment; Foreign Countries; *Income; *Labor Force; *Paying for College; Policy Formation; Public Policy; *Student Loan Programs; Technological Advancement
IDENTIFIERS	*Mexico

ABSTRACT

Educational attainment levels increased dramatically for Mexico's labor force in the 1980s and early 1990s. In parallel, the country experienced a pronounced increase in earnings inequality from 1984 to 1994, reflected in a higher dispersion of wages and an absolute decline in the real incomes of less educated, poorer Mexicans. This situation presents policymakers with a tradeoff between efficiency considerations (favoring increased spending on higher education) and equity considerations (favoring a more equal distribution of per student spending) in the allocation of fiscal resources to education. This analysis concludes that the accumulation of human capital, as proxied by educational attainment, does not appear to be among the factors responsible for Mexico's disappointing growth performance since the early 1980s. The most persuasive hypothesis explaining this increased earnings inequality is that it is caused by an increased rate of skill-biased technological change, the transmission of which to developing countries may have been facilitated by the increased openness of those economies. The increased earning inequality is associated with a higher dispersion of the average wages received by workers with different schooling attainment. This raised the private rates of return to higher levels of education, in effect reversing the traditional pattern of rates of return, where the highest rates are reported for the primary level. The social rates of return also show this reversal in the relative magnitude of rates of return. The solution the paper recommends is for the government progressively to pass on a greater share of the costs of higher education to its direct beneficiaries, while facilitating the private absorption of those costs through student loan programs designed to correct market failures in the financial sector. An annex contains technical notes on calculating the rate of return. (Contains 3 figures, 12 tables and 24 references.) (SLD)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 454 774

EDUCATION AND EARNINGS INEQUALITY IN MEXICO

Ulrich Lächler*

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

U. Lachler

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

* Principal Economist, Mexico Country Department, World Bank.

This paper was prepared with research assistance from Gladys Lopez Acevedo, who processed the ENIGH data discussed therein. Many helpful comments were received from Barry Bosworth, Nancy Gillespie, George Psacharopoulos, Rosa-Maria Rubalcava, Fernando Cortes, Enrique Hernández Laos, and Eduardo Velez.

BEST COPY AVAILABLE

HED34431

EDUCATION AND EARNINGS INEQUALITY IN MEXICO

The education attainment of Mexico's labor force increased dramatically during the 1980s and early 1990s, contrasting markedly with the uneven accumulation of physical capital. At the same time, the rates of return on investments in different levels of schooling show significantly less dispersion than they did a decade ago. This suggests that investment in education has been taking place in a more socially efficient manner. Another visible development over the last decade, however, has been a significant increase in earnings inequality, accompanied by an absolute decline in the real incomes of the less educated, poorer members of society. This comes as something of a surprise in light of the great equalizing properties generally attributed to education, but is a phenomenon that in recent years also has been observed in other developing as well as developed countries.

The increased wage dispersion presents policymakers with two challenges: the more immediate one is how to respond to the decline in real incomes facing a large share of the country's population. The other related challenge, with implications for the country's long-term growth prospects, concerns a tradeoff in the allocation of resources in education and is especially acute in relatively centralized education system such as Mexico's. Since the increased wage dispersion raises the rate of return from investing in higher education, economic efficiency considerations would dictate a response that devotes relatively more resources to higher education versus other levels. A resource reallocation to that effect, however, means transferring resources toward segments of the population that are already better off, thus conflicting with equity considerations.

Mexico's policymakers were able to avoid this policy dilemma over the last decade: as shown below, the allocation of public spending on education has become somewhat more egalitarian and, at the same time, the social rates of return associated with different levels of education have become more uniform. This happy coincidence was possible only because Mexico started out with a very distorted resource allocation in education. As past resource misallocations are corrected, however, the opportunities for further improvements in resource allocation within the existing, centralized education framework are progressively exhausted. This is likely to result in increasing tensions in the allocation of fiscal resources -- between efficiency considerations that argue for more resources to higher education and egalitarian considerations that argue for a more equal distribution of transfers within and outside the education sector. This paper argues that the most promising way of dealing with these tensions is by seeking to clarify the roles for the public and private sectors in education and by encouraging greater private participation in higher education.

A. The Growth of Education Attainment[1]

[1]The following discussion primarily focuses on the evolution of education attainment levels as measured by years of schooling, on the assumption that the quality of education has remained more or less

Education attainment levels increased rapidly in most developing countries since the 1950s; Schultz (1988). While Mexico also partook in that development, earlier studies had identified a significant lag in its education indicators. Londoño (1996), for example, points to an "education deficit", according to which the Latin American countries in general, and Mexico in particular, have approximately two years less of education than would be expected for their level of development (as measured by per-capita incomes). Elias (1992) finds that education was the most important source of labor quality improvement in Latin America between 1950 and 1970, but points out that such improvements did not take place to the same extent in Mexico. This changed dramatically in the 1980s, as shown in the scatter diagram below.

Figure 1 describes the relation between income per capita and average years of schooling of the population aged 15 years or more, using stacked cross-country data for the years 1960, 1970, 1980, 1985 and 1990.[2] Mexico's level of education

---

constant. Although it is of great interest in this context, information on the quality of education in Mexico is very scarce. The most common measures of "quality" are based on input measures, (e.g., real expenditures on education per student, student-teacher ratios, or class-density variables) or secondary performance variables (e.g., evolution of repetition and desertion rates). On the basis of these measures, Mexico also has performed comparatively well over the last few decades. These measures are not very satisfactory, however, as they reflect many other influences in addition to the quality of instruction as reflected in the acquisition of knowledge and skills. A comprehensive education survey was conducted in Mexico in 1995 as part of the Third International Mathematics and Science Study (TIMMS) that may have yielded important data to permit correlating the preceding education sector characteristics with academic achievement levels to obtain a better understanding of the determinants of education quality in Mexico. That data set has not been made publicly available.

[2] The scatter diagram in Figure 1 is based on 317 observations from five different years. The observations pertaining to Mexico, ordered by date, are as follows:

	Ave. Schooling (years)	Ln (GDP per capita; 1980 US$)
1960	2.76	7.95
1970	3.68	8.29
1980	4.77	8.71
1985	5.20	8.63
1990	6.72	8.67

The trend line represents the least square regression line given by:

$S = -13.17 + 2.28\ \text{Ln(GDPcap)}$ Adj. $R^2 = 0.68$

(-18.7) (26.0) t-values in parentheses

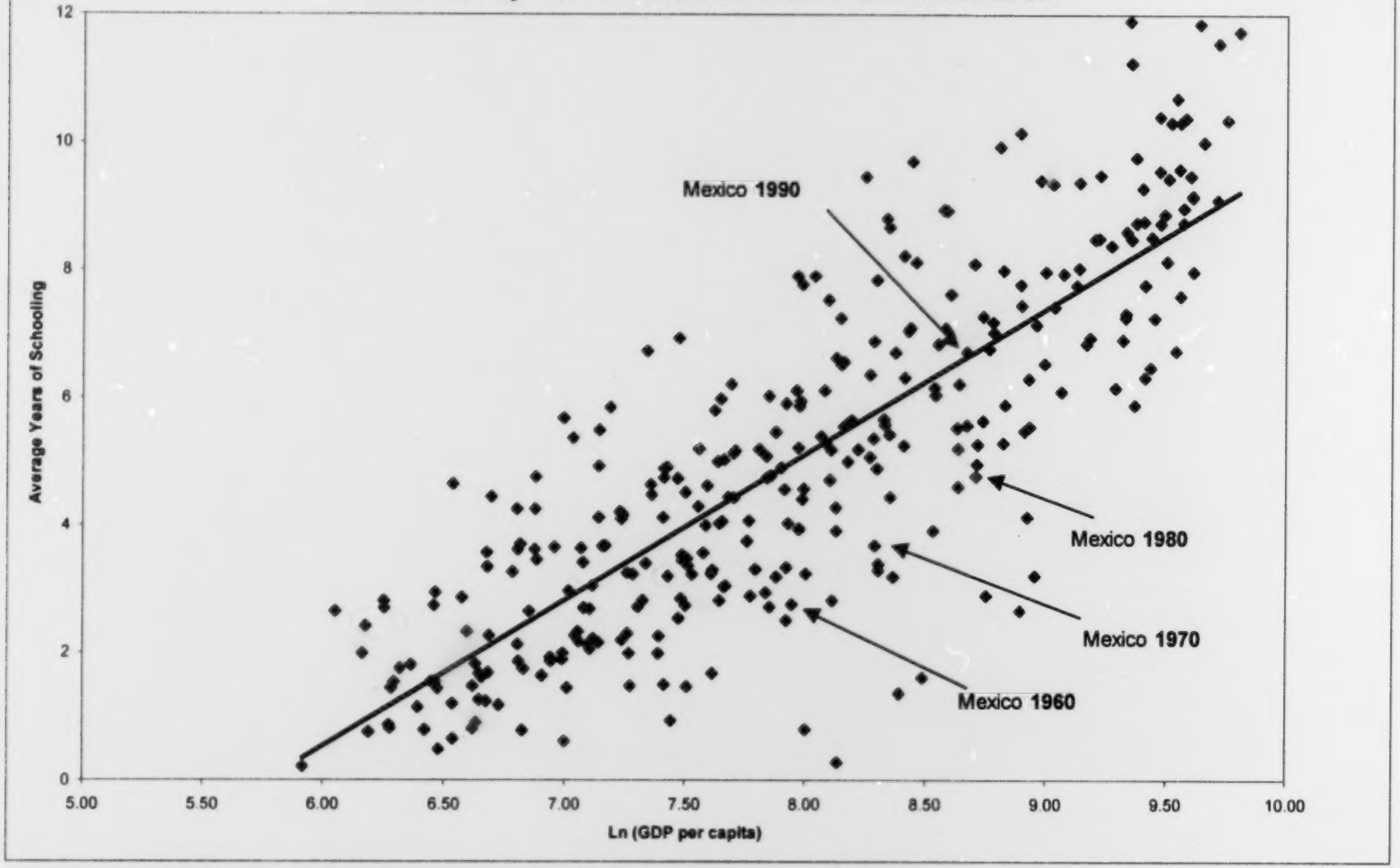
The application of Ramsey's RESET test to this regression equation failed to detect a specification error; unlike with the alternative specification of type: $S = a + bX + cX^2$. However, coefficient stability tests indicated that the trend line is not constant across decades. This is reflected in the upward drift of the coefficients associated with the dummies in the following equation:

$S = -13.20 + 2.21\ \text{Ln(GDPcap)} + 0.023\text{DUM70} + 0.525\text{DUM80} + 0.833\text{DUM 85} + 0.997\text{DUM90}$

(-19.0) (25.4) (0.1) (1.7) (3.0) (3.6)

Adj. $R^2 = 0.70$, t-values in parentheses

Figure 1
Cross-Country Relation between Education Attainment and GDP



Source: Penn World Tables, mark 5.6, and Barro-Lee data set on international measures of schooling.
The chart is based on stacked cross-country data for 1960, 1970, 1980, 1985 and 1990. Country coverage varies according to data availability.
U.Lächler

attainment in 1960 was significantly below the world mean for countries at similar levels of economic development. Although Mexico's education attainment increased steadily over the following two decades, it continued to remain below the international trend line. In the 1980s, however, the growth of education attainment in Mexico accelerated, permitting it to catch up to international standards by 1990; where its placement in Figure 1 is slightly above the trend line.

The closure of Mexico's education gap vis-à-vis the rest of the world was hastened in part by the country's economic stagnation. Mexico's real GDP per capita in the mid-1990s was roughly the same as it had been in the first half of the 1980s. Had Mexico continued to grow at the same pace as in the 1960s and 1970s (and assuming that the gains in education attainment remain the same), its 1990 placement in Figure 1 would have continued to remain below the cross-country trend line, though at a much reduced distance compared to previous years.[3]

The preceding observation, however, should not detract from the remarkable increase in schooling that occurred during the 1980s. While average schooling level in Mexico increased by roughly one year per decade during 1960-1980 (from 2.76 to 4.77 years), it increased by two years in the decade between 1980-1990. As described in Psacharopoulos et al (1996), this rapid improvement reflects the great efforts made in Mexico to increase both the quality of and access to public education since 1950. A consequence of these developments is that the share of workers with less than primary education decreased from almost half of the labor force in 1984 to 36 percent in 1994, while the share of workers with at least a completed secondary education increased from 26 to 39 percent; Table 1.

The rapid growth of education attainment in Mexico also stands out in recent cross-country growth studies (e.g., Bosworth, 1997), which decompose per capita growth into the contributions from several factors, including education attainment as a proxy for human capital accumulation, in a growth accounting framework. These studies reveal a major break in Mexico's growth performance after 1982. A similar break is visible in the accumulation of physical capital and in total factor productivity growth, but not in the accumulation of schooling, which performed well by world standards.

---

[3] Mexico's education deficit -- i.e., the vertical difference from the world trend line in Figure 1 -- has declined significantly since 1960, with the main catch-up occurring in 1980-90. This is clearly visible from Figure 1, but also appears under less restrictive specifications of the estimated trend line. The differences from the trendline are stated below, beginning with the most restrictive specification:

Equation Specification	1960	1970	1980	1985	1990	Std. Error of Regression
	(difference from world mean in years)					
Stacked, without dummies	-2.22	-2.09	-1.95	-1.36	+0.08	1.52
Stacked with dummy variables	-1.62	-1.49	-1.82	-1.54	-0.26	1.48
Individual equations for each year	-1.55	-1.41	-1.84	-1.59	-0.26	na

B. Changes in Earnings Inequality

At the same time as this remarkable advance in education attainment was taking place, the distribution of income in Mexico worsened notably; see e.g., De la Torre (1997), Pánuco-Laguette and Székely (1996). For example, the Gini coefficient of Mexico's total income distribution increased from 0.43 in 1984 to 0.48 in 1994. This deterioration took place before the 1995 recession and, thus, cannot be attributed to business cycle effects. Instead, the increase in overall income inequality appears to be closely related to an increase in the dispersion of wages and salaries across different schooling levels. Table 1 describes the change in real wages between 1984 and 1994, using two concepts of remuneration (described in Section D.)

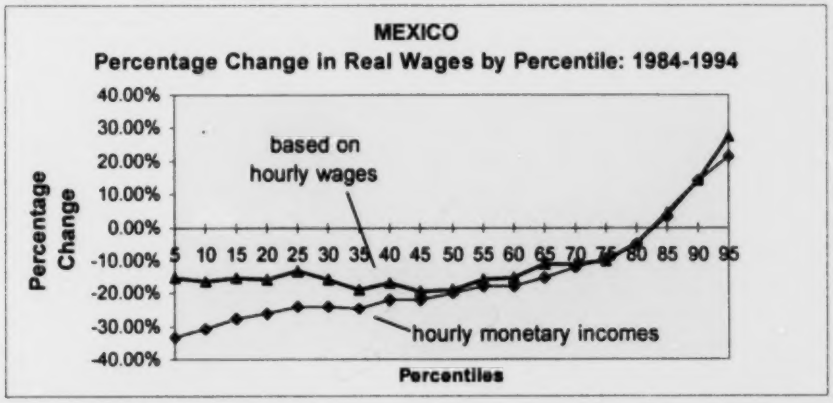
Table 1: Real Wage Rates in Mexico
(Unless stated otherwise, all figures refer to hourly rates expressed in constant 1994 Pesos)

	Wages & Salaries			**Monetary Income**			*Share of Workers*	
Schooling Level	1984	1994	difference	1984	1994	difference	1984	1994
0 - less than primary	3.17	3.08	-2.8%	4.83	4.12	-14.7%	48.1%	35.7%
1 - primary complete	5.23	4.42	-15.5%	7.90	5.39	-31.8%	26.3%	25.4%
2 - secondary complete	6.55	5.83	-11.0%	7.55	6.90	-8.6%	13.3%	21.3%
3 - preparatory complete	9.62	11.68	21.4%	10.64	12.84	20.7%	7.8%	11.1%
4 - university and above	14.93	21.96	47.1%	16.94	25.55	50.8%	4.5%	6.6%
weighted average	**5.62**	**6.88**	**22.4%**	**7.00**	**7.57**	**8.1%**		

Source: Own calculations based on ENIGH84 and ENIGH94. All figures are weighted averages using expansion factors to reflect national representation.

Even though the average wage increased during the decade spanned by Table 1, most workers experienced a significant decline in their wages. This disparity in the evolution of real wages is most visible in Figure 2, which shows that 83 percent of the working population experienced a decline in real wages during the last decade.

Figure 2



Source: ENIGH84 and ENIGH94.

BEST COPY AVAILABLE

The deterioration of real wages was partly compensated for through increases in hours worked, suggesting backward bending labor supply curves at low income levels. This was not enough, however, to prevent an erosion of overall income for the majority of workers; Table 2.

Table 2: Average Hours Worked and Income Received

Schooling Level	**Wage Earners**			**Monetary Income Recipients**		
Avg. Hours per Week	1984	1994	change	1984	1994	change
0 - less than primary	44.8	50.7	13.3%	43.0	46.8	8.8%
1 - primary complete	45.1	49.0	8.6%	44.7	48.2	7.9%
2 - secondary complete	44.4	46.8	5.6%	44.5	46.8	5.2%
3 – preparatory complete	38.7	43.7	12.8%	38.9	44.1	13.4%
4 - university and above	41.6	44.7	7.5%	42.2	44.7	5.9%
weighted average	*44.1*	*47.8*	*8.5%*	*43.3*	*46.7*	*7.8%*
Avg. Annual Income (in 1994 Pesos)	1984	1994	change	1984	1994	change
0 - less than primary	7,530	7,674	1.9%	9,514	8,308	-12.7%
1 - primary complete	12,705	11,316	-10.9%	15,888	13,222	-16.8%
2 - secondary complete	15,343	14,097	-8.1%	16,995	15,978	-6.0%
3 - preparatory complete	18,643	25,709	37.9%	19,483	27,898	43.2%
4 - university and above	33,899	55,428	63.5%	38,741	62,769	62.0%
weighted average	*13,057*	*16,658*	*27.6%*	*14,268*	*16,931*	*18.7%*

Source: Own calculations based on ENIGH84 and ENIGH94. All figures are weighted averages using expansion factors to achieve representation at the national level.

One explanation for a deteriorating income distribution that is closely connected to the advance in education attainment has been made by Ram (1990). Education is generally considered to have an equalizing effect on incomes, which would indicate a positive relation between measures of income inequality and of education inequality. However, the dispersion of schooling attainment and the mean level of schooling need not be positively related in a monotonic manner. Upon exploring this relationship by way of a cross-country analysis, Ram finds a curvilinear (Kuznets-type inverted-U) relation between the mean level of schooling and schooling inequality in the labor force.[4] That is, as schooling expands, education inequality first increases, but then starts declining after reaching a peak. That turning point occurs when mean schooling is about 6.8 years for the full sample of countries, and 6.3 years for the sub-sample of less

[4]The theoretical rationale underlying this finding is reminiscent of the "Laffer curve" in public finance theory. It stated that tax revenues are 0 when tax rates are 0 and will again become 0 when the tax rate approaches 100% (as that would eliminate all incentive to work.) Since revenues are positive at tax rates between 0% and 100%, the revenue-rate relationship must broadly approximate an inverted-U. In the case of education, the "theory" states that when no one in society is educated, the distribution of education is perfectly equal, as it would be when everyone in society has a Ph.D. (considered for simplicity to be the maximal level of education attainment). In the process of going from a Zero-education society to the Land of Ph.D.s, the distribution of education must perforce become more unequal before it ultimately improves again.

developed countries. So, if Mexican schooling levels had been below the turning point, it is conceivable that the rapid increase of education attainment in the 1980s may have contributed to greater earnings inequality via an increased inequality of schooling attainment.

The evidence does not support this explanation for the increased earnings inequality in Mexico: using Ram's (1990) method of calculation based on 5 schooling levels, the mean level of schooling in Mexico was 6.45 years in 1984 and 7.65 years in 1994. This means that Mexico started in 1984 with a mean level of schooling that was slightly above the "turning point" according to the LDC subsample and slightly below the turning point for the full sample of countries, while it ended up in 1994 with a mean schooling level substantially above the turning point. If the curvilinear relation is evenly distributed around the turning point, we should clearly expect the inequality of schooling in Mexico to have declined over that decade.

This conclusion is confirmed by decomposing the change of the Gini Index between 1984 and 1994 into the proportion that is attributable to changes in the wage rate, in hours worked and in education attainment. Table 3 presents the results of such an exercise, both for the distribution of Wage and Salary incomes, as well as the broader Monetary income concept. For each income concept, several "synthetic" Gini indexes are calculated:[5] the first two, Gini-1984 and Gini-1994, are based on the distribution of wage rates, hours worked and education attainment that pertain in each year. The next three indexes are derived by recalculating the 1984 Gini index after successively replacing the 1984 distribution of wage rates, hours worked and schooling attainment by its 1994 counterpart. The second column under each income concept reports the value of each Gini index calculated in this manner, while the third column reports the percentage difference of these values relative to the original 1984 Gini index.

Table 3: Sources of Increased Earnings Inequality

Wages & Salaries			Monetary Income		
	Level	%change over Gini-84		Level	%change over Gini-84
Gini 1984	0.2281	0.0	Gini 1984	0.1712	0.0
Gini 1994	0.3034	33.0	Gini 1994	0.2812	64.3
Gini-Δwage	0.2962	29.9	Gini-Δwage	0.2543	48.5
Gini-Δhours	0.2208	-3.2	Gini-Δhours	0.1696	-0.9
Gini-Δeducation	0.2222	-2.6	Gini-Δeducation	0.1710	-0.1

Source: Own calculations based on data from Tables 1 and 2.
Note: the %-changes in the lower half of each column do not add up to the %-difference between Gini-94 and Gini-84 due to large rounding errors.

Table 3 indicates that the "synthetic" Gini index increased by 33 percent between 1984 and 1994 (under the Wage and Salary income concept) and that over 90

[5] These "synthetic" Gini indexes are constructed under the assumption that all the individuals with a given schooling level earn the same wage rate and work the same number of hours as the averages shown for each schooling level in Table 2.

percent (29.9 ÷ 33.0) of that increase in earnings inequality is attributable to the change in the distribution of wage rates over that decade. (Using the broader Monetary income concept, around 75 percent of the increase in earnings inequality is explained by the change in wage rates.) On the other hand, changes in the distribution of education attainment are shown in both cases to have contributed to a reduction in earnings inequality, though by modest amounts; -2.6 and -0.1 percent. Changes in hours worked also contributed modestly toward reducing income inequality. In light of this evidence, we can safely rule out increased schooling inequality as an explanation of the increased income inequality that took place in Mexico over the last decade.

Three broad hypotheses that do not hinge on changes in the distribution of education attainment are frequently advanced to explain the similar increases in earnings inequality experienced in Mexico and other countries.[6] These link the increase of earnings inequality to (i) the increased openness of the economy, (ii) institutional changes in the labor market, and (iii) skill-biased technological change. The first of these hypotheses argues that as trade barriers are reduced, an economy is placed under increased competitive pressures to specialize along its lines of comparative advantage. A developed country that is relatively high skill-abundant, like the United States, will be induced to specialize in high skill- or education-intensive activities as its low-skill industries come under increased competitive pressure from low skill-abundant, low-wage countries.

This explanation has several problems when applied to the United States, and becomes even less persuasive when applied to Mexico. Mexico greatly liberalized its trade regime since 1984. However, the reduction of its trade barriers has mostly been vis-à-vis imports from the developed countries, notably the United States and Canada, whose share in total Mexican merchandise imports increased from 68 percent in 1985 to 73 percent in 1993 (and to 77.5 percent in 1996). Since Mexico is a low skill-abundant country compared to its two northern neighbors, it would be expected that the liberalization of trade would have induced a specialization pattern that would raise the relative demand (and hence wages) for the lesser educated members of the labor force. This did not happen. Instead, the increase in earnings inequality observed in Mexico is identical to that observed in the United States: less educated workers experienced real wage declines, while highly educated workers experienced real wage improvements.[7]

The second explanation revolves around institutional changes such as reductions in the minimum wage, the decreasing strength of trade unions and the declining

---

[6] See, for example, the Symposium on Wage Inequality published in Journal of Economic Perspectives (1997) and the Symposium on "How International Exchange, Technology and Institutions Affect Workers" published in The World Bank Economic Review (1997).

[7] The trade-based explanation may still be relevant to the extent that greater openness facilitates the transfer of ideas and technology, which is identified below as the more persuasive explanation of the increase in earnings inequality. A variant on the globalization/technology nexus explanation, advanced by Feenstra and Hanson (1994), involves outsourcing behavior where multinational enterprises in the developed country relocate their lower skill-intensive activities to the less skill-abundant developed countries. However, what is a low skill activity in the United States may be a high-skill activity in Mexico, which could explain the identical evolution of earnings inequality in both countries.

share of state-owned enterprises. The existence of a binding minimum wage, for example, truncates the lower end of the wage distribution. As the minimum wage is allowed to erode away, say through inflation, it becomes less binding by moving further down the low end of the wage distribution, with the result that, *ceteris paribus*, a higher share of wages will lie below the previous minimum wage level. That translates into an increased dispersion in wages and earnings. Similarly, strong trade unions have often been found to exert an egalitarian effect on the wage distribution, while at the same time commanding a wage premium for union members. Any waning of union strength, as happened in the United States over the last two decades, therefore would contribute to an increase in wage dispersion. A review of institutional developments in the Mexican labor market by Hernández et al (1998) showed that these factors may have contributed to a higher wage dispersion. Most important in this regard was the apparent decline in union strength, in part due to the privatization of public enterprises during the early 1990s. That review also showed that the real decline of minimum wages since the early 1980s may have had an impact as well, but mainly confined to wages in the primary sector.

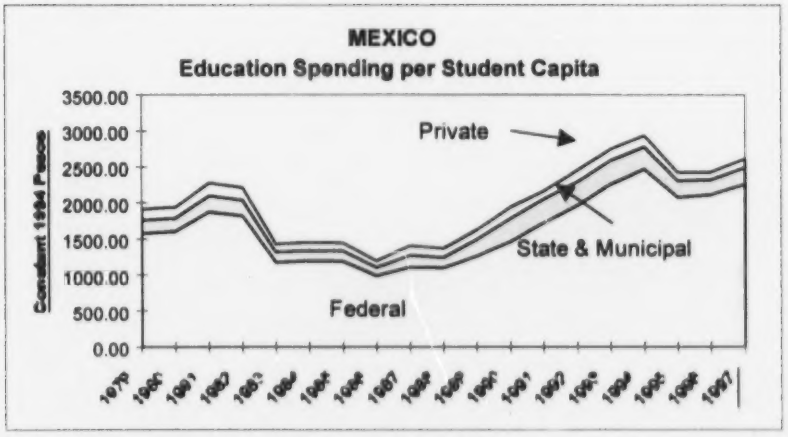
Perhaps the most persuasive explanation, both for the United States and Mexico, is that which links earnings inequality to skill-biased technological changes that raise the relative demand for higher-skilled labor. According to the typology used by Johnson (1997), the type of technological change that drives up the wages of more highly skilled workers and drives down those of less skilled workers -- as occurred in both the United States and Mexico -- is extensive skill-biased technological change. Under this type of technological change, skilled workers become more efficient in jobs that were traditionally performed by unskilled workers. A demand/supply analysis in Hernández et al (1998) provides support for this explanation in the case of Mexico: it showed that secular changes in demand for workers differentiated by education level were the dominant force behind recent adjustments in the Mexican labor market, with the market for more educated workers dominated by intra-sectoral increases in demand, and for less educated workers by intra-sectoral decreases in demand, independent of gender and experience. That outcome suggests that the rise in wage dispersion originates from changes in the intra-sectoral production structure, which favors educated versus uneducated workers, rather than from changing trade patterns, which would affect the demand for labor differently across sectors.[8]

C. Some Background Facts on Education Spending

Mexico's overall spending on education, as a share of GDP, is slightly above the OECD average and compares favorably with education spending levels in other developing countries. Total spending per student in Mexico increased steeply in the second half of the 1980s and early 1990s, even though the total student population increased, from 24 million in 1985 to 27 million in 1995. Part of this increase reflects a rebound from the expenditure cuts that were made in response to the debt crisis in 1982. By 1994, however, total spending on education had risen to 5.4 percent of GDP, or almost a full percentage point above its previous peak of 4.5 percent reached in 1982.

[8] These findings correlate with earlier findings for Mexico (Cragg and Epelbaum, 1994) as well as for Chile, following its trade liberalization program (Robbins, 1994).

Figure 3



Source: Informe de Gobierno, 1989 and 1997.

Figure 3 describes the evolution of funding for education in Mexico since the early 1980s. Private spending represented less than 10 percent of total expenditures in education in 1987, and has fallen to below 5 percent in recent years. (This figure somewhat underestimates total private costs, which, with some adjustments noted in the Annex could be around 27% of total education spending.) Similarly, the share of state and municipal spending peaked at 17% of total spending in 1990, but since then also declined to less than 10 percent of total spending. The federal government, on the other hand, currently accounts for 87 percent of total sector spending. These figures are not far out of line with those from an OECD review of education expenditures, which indicated that in 1994, about 19 percent of spending on education in Mexico came from private sources, compared to a country average of 13 percent for the whole of the OECD.[9]

Mexico does not stand out particularly in the preceding comparison. As in most countries, the public sector directly or indirectly finances the lion's share of education expenditures. Mexico does stand out in contrast to its OECD partners, however, when these expenditures are disaggregated by level of instruction. As shown in OECD (1998, pg. 97) the ratio of spending per student at the tertiary level compared to spending at the primary level exceeded 500 percent in 1994 and was the highest among OECD countries. (The ratio in Korea, for example, is close to the OECD average of 264 percent, or less than half the Mexican ratio.)

Table 4: Federal Education Spending per Student by Level

	Federal Spending per Student (constant 1994 Pesos)				(as share spent on Primary)		
	primary	secondary	preparatory	university	prim.	second.	prep. univ.

[9]These figures comprise total expenditures on education, including privately purchased materials, whereas the earlier figures shown in Table 3 are identical to the what the OECD expenditure review refers to as direct spending on educational institutions.

1980	1166.1	2571.8	4823.7	8667.3	1	2.2	4.1	7.4
1981	1447.6	2790.6	6156.9	11544.0	1	1.9	4.3	8.0
1982	935.8	2027.3	4586.4	10061.0	1	2.2	4.9	10.8
1983	710.5	1562.0	2714.7	6451.4	1	2.2	3.8	9.1
1984	691.1	1644.3	3108.4	6544.2	1	2.4	4.5	9.5
1985	715.0	1473.3	3582.2	7174.8	1	2.1	5.0	10.0
1986	961.5	2094.6	3329.3	11686.2	1	2.2	3.5	12.2
1987	683.7	1308.3	3364.0	6334.3	1	1.9	4.9	9.3
1988	665.1	1303.0	3423.0	6520.2	1	2.0	5.1	9.8
1989	734.0	1438.9	3756.0	6176.3	1	2.0	5.1	8.4
1990	808.4	1685.8	3502.8	6473.5	1	2.1	4.3	8.0
1991	1011.4	1942.6	3772.9	6898.3	1	1.9	3.7	6.8
1992	1285.9	2318.7	3384.3	9313.2	1	1.8	2.6	7.2
1993	1584.6	2568.4	4304.6	11637.2	1	1.6	2.7	7.3
1994	1731.3	3139.4	5215.1	13253.0	1	1.8	3.1	7.7
1995	1679.0	2511.0	4508.1	11202.3	1	1.5	2.7	6.7
1996	1647.7	2464.2	4442.9	11328.5	1	1.5	2.7	6.9
1997	1811.9	2709.7	4882.1	12692.2	1	1.5	2.7	7.0

Source: Presidencia de la Republica, Primer Informe de Gobierno, 1989, and Tercer Informe de Gobierno, 1997.

The great disparity in per-student spending at different education levels in Mexico is also reflected in Table 4, which only refers to federal expenditures. This Table also shows, however, that the evolution of public spending on education in Mexico has become more egalitarian across different schooling categories over time. In the early 1980s, the amount of federal spending per university student averaged 10 times the amount spent per primary student. This ratio fell to around 7 times in the early 1990s. Federal spending on the other levels relative to the primary level indicate a similar decline, even though the absolute amounts increased at all levels. In other words, even though the recent pattern of spending on education in Mexico exhibited a highly uneven bias in favor of tertiary education relative to other categories, the pattern of spending in earlier periods exhibited and even greater bias.

D. The Rates of Return on Investments in Education

One way to assess the economic merits of the preceding spending patterns, considered as investments in education, is by comparing their relative rates of return. This section compares the rates of return to education as derived from several human capital earnings functions. These were estimated with data from two income-expenditure surveys (ENIGH) carried out by the National Statistical Institute (INEGI) in the third quarters of 1984 and 1994. These two survey years provide an excellent setting for comparisons: first, both years can be considered macroeconomically comparable in that the economy is neither in recession nor booming. Secondly, both years are almost equi-distant in time from the major stabilization and structural reform measures implemented by the Mexican Government in the latter half of the 1980s. They are especially suitable, therefore, for making 'before and after' comparisons.

The ENIGH surveys identify the educational attainment, income received and number of hours worked per week by each family member.[10] Income is differentiated into about 25 items, which were aggregated into three broad categories: (i) wage and salary income, (ii) current monetary income, which includes wages and salaries, income from self-employment, property income and rents, monetary transfers and income from financial assets, and (iii) total current income, which includes all of the above items, plus non-monetized income such as imputed rent, in-kind transfers and stock dividends. In contrast to this disaggregation of income sources, the ENIGH surveys do not differentiate the number of hours worked per week by activity. The rates of return calculated below are based on two measures of earnings per hour: the wage rate, which refers to wage and salary earnings per week, divided by the total number of hours worked per week, and the monetary earnings rate, which refers to current monetary income divided by the same number of hours worked per week.

Tables 5 and 6 present the private and the public rates of return on investments in education in Mexico. The method used to estimate these rates of return is explained in detail in the Annex. The distinction between public and private rates of return in this context centers around who bears the cost of financing the investment in education: in both cases, the benefits of an additional year of schooling are reflected in the stream of additional earnings that accrue to an individual as a result of that additional education. The rate of return to education is then the discount rate that equates the present value of this stream of additional earnings to the present value of the costs incurred. When only private costs are considered in this calculation, it is termed the private rate of return, and when all public and private costs are considered, it is termed the social rate of return.

Table 5: Private Rates of Return to Schooling in Mexico
(Private cost of education is 100% of foregone full year's earnings; $K^p = 1$.)

	Wage Earners		Monetary Income Recipients	
	1984	**1994**	**1984**	**1994**
Average "Mincerian"	15.2%	16.7%	14.6%	17.2%
by schooling level				
1 - primary complete	16.9%	13.8%	14.7%	14.3%
2 - secondary complete	13.9%	16.7%	14.5%	16.0%
3 - preparatory complete	15.5%	18.2%	14.4%	19.2%
4 - university and above	10.3%	19.9%	12.8%	20.6%

Source: Tables A1and A2, using the method described in the Annex.

Two phenomena about the private rates of return draw attention in Table 5: the first is that the overall rate of return to education has increased between 1984 and 1994, as seen from the "Mincerian" rates of return. This is a direct consequence of the increased dispersion in wages that took place over that period. Secondly, the rates of

[10] Several sources of potential bias in the data base require attention: first, casual evidence indicates that the sample of families included in the ENIGH surveys is truncated in that the very rich and the very poor appear to be underrepresented. Indigenous groups, which are estimated at around 10 percent of Mexico's population, also appear underrepresented. Finally, there appear to have been some sampling problems involving the 1984 survey (the first year the survey was conducted by INEGI), which may have affected its comparability with the 1994 survey.

return for different levels of schooling have changed in ranking. In 1984, the lower levels of education uniformly yielded greater rates of return than investments in higher levels of education. This ranking is completely reversed in 1994, with the private rates of return to primary education declining significantly below the rates of return to higher education, which almost doubled.[11]

Table 6: Social Rates of Return to Schooling in Mexico

	Wage Earners		Monetary Income Recipients	
Schooling Level	**1984**	**1994**	**1984**	**1994**
1 – primary complete	15.5%		13.7%	11.8%
2 – secondary complete	11.3%		13.1%	12.7%
3 – preparatory complete	12.4%		12.2%	14.4%
4 – university and above	13.0%		9.6%	13.9%
	12.9%			
	13.2%			
	7.6%			
	13.2%			

Source: Tables A1and A2, using the method described in the Annex.

As in the case of the private rates of return, the social rates in Table 6 also indicate a decline in the rate of return for primary education and increases in the rates of returns for higher education during the decade between 1984 and 1994. A noteworthy difference to the private rates of return, however, is that the social rates of return exhibit a much lower dispersion across schooling levels in 1994 than in 1984. That is, the social rates of return associated with different investments are much closer together, which, in a standard capital market context, suggests a decline in market segmentation and, thus, a more efficient allocation of investment resources in education.

E. A Policy Dilemma

A general efficiency criterion for investing is that resources should be first invested in those activities that yield the highest rate of return until the point where the marginal rate of return drops to the level of the activity with the next highest rate of return. Barring any corner solutions and assuming that investments in education exhibit decreasing marginal rates of return, this rule will have the effect of equating rates of return across different activities. Suppose that the government were following this efficiency rule in its allocation of public resources in education in the face of increased wage dispersion. As shown in the Annex, that would mean that the pattern of public spending in education would have to adjust in the same direction as the private rates of return to education. In other words, as the dispersion of wages increases, the private rates of return on investments in higher education increase. Other things equal, that also raises the social

[11] The private rates of return in Table 5 pertaining to 1984 are very similar to the private rates reported for Mexico in Psacharopoulos (1994a). The main difference arises with regard to primary education, where his paper reports a significantly higher return. The reason is because Psacharopoulos assumes that the foregone earnings from attending primary school are roughly half the figure used in our calculations, which are based on Annex Table A3. Psacharopoulos' lower assumption is meant to adjust for the very low opportunity cost of young children attending primary school.

rates of return for higher education levels in the same proportion. Therefore, to prevent a misalignment of the social rates of return in education, the government would have to shift resources away from primary education (which raises its rate of return) and toward higher education (thereby causing a compensating reduction in its marginal rate of return).

The preceding response, based on efficiency considerations, would conflict with equity considerations in the short run, though not necessarily in terms of long term consequences. Insofar as the primary level encompasses a higher proportion of individuals from poor households than do higher education levels, the efficient response would change the pattern of direct spending toward more affluent individuals. Moreover, that change in spending would come about after the already existing income disparities across households had been aggravated by the movement in relative wages. Over time, the increased spending on higher education leads to a higher relative supply of more educated workers, which depresses their relative wage and, thereby, has an equalizing effect on total earnings. That equalizing consequence occurs in the long run, however, and would have little impact on the earnings of the currently affected generation of workers.

A surprising thing about Mexico over the last decade is that even though public spending has become more evenly distributed, the social rates of return in Table 6 also have become more uniform in 1994 compared to 1984. The answer to this puzzle lies in the very distorted pattern of education spending that existed at the beginning of the period. Public education spending in the early 1980s was very skewed toward higher education, which exhibited the lowest rates of return. That is, it was both inefficient and inequitable.[12] By moving toward a more even distribution of per capita spending across different levels, equity was improved. At the same time, the external environment changed in a manner that raised the relative return to higher education, thereby tending to make more efficient what had initially been an inefficient allocation of resources.

As the social rates of return to education become equalized, however, the opportunities for achieving gains by undoing past mistakes will be exhausted. That means that policymakers will no longer be able to evade this equity-efficiency tradeoff, assuming that the rate of skill-biased technological change continues as before. So long as education spending remains concentrated at the federal government level, that same government will have to decide whether to respond to exogenous increases in the rates of return to higher education by shifting more resources toward higher education at the expense of increased inequity in spending, or by maintaining a more equitable spending distribution at the expense of increased inefficiency.

There is no easy response to this dilemma. The politically least controversial response of assigning more resources to higher education through a higher overall budget to education runs into fiscal constraints.[13] Barring more public resources,

---

[12] This observation is consistent with earlier findings by Elias (1992), which indicated that growth in the "quality" of the labor force contributed little to Mexico's overall economic growth in the 1960s and 1970s, compared with other Latin American countries.

[13] A sense of the potential magnitude of these fiscal costs can be obtained from OECD (1997, Chart B1.3). It estimates that raising Mexico's enrollment ratios in tertiary education to the OECD average level, would involve an increase of expenditures on educational institutions by 1.4 percent of GDP. This is

the only option for expanding of investment in higher education (desired on efficiency grounds) without cutting public funding for primary education is by attracting greater private sector participation.

To facilitate greater private participation, it is useful to distinguish more clearly the roles of the private and public sectors. The classic assignment of responsibilities limits the public sector's involvement to the provision of public goods, as well as correction for market failures and externalities. In that context, it is often argued that the positive externalities from education are highest at the primary level and progressively decline at the higher levels; Schultz (1988). That is, at higher education levels, the individuals receiving the education capture a progressively larger share of the total social benefits yielded from the education in the form of higher wages. That being the case, there is less of a risk that private individuals left to their own devices would underinvest from a social viewpoint in higher education than that they would underinvest in primary education. The externalities from different levels of education are difficult to measure and compare empirically. However, if the rationale for state intervention in the provision of higher education services is based on the argument that rates of return were too low to induce the right amount of investment from the private sector, that rationale has certainly become less compelling with the significant increases in private rates of return observed in recent years.

The options for greater private sector participation in higher education are many. They range from greater participation in the funding of education services to greater participation in the direct provision of services.[14] At the very least, the rise in private rates of return for higher education makes a compelling case for increasing the level of cost-recovery in higher education, independently of whether it is the State or the private sector that provides those services. The lack of long-term financing for private investments in higher education represents an important obstacle to the implementation of this solution. That obstacle is rooted in a systemic market failure (due, among other, to bans on indentured servitude) that poses problems in most countries, but is especially pronounced in Mexico on account of its very weak financial system. The proper role of government is precisely to correct or compensate for such market failures. A promising way to correct these market failures in Mexico is through student loan programs, or means-tested financial aid and scholarship programs. These programs are currently almost non-existent in Mexico, as the public sector has relied mainly on the direct, cost-free provision of higher education services. The scholarship programs suggested here as an alternative promise to yield a more efficient resource allocation than a cost-free provision of services. Although such programs have rarely been devoid of subsidy components wherever they have been implemented worldwide, that subsidy is more closely targeted to the source of the market failure.[15]

---

almost twice the size of the fiscal revenue shock (estimated at 0.8 percent of GDP) caused by the decline of oil prices in late 1997 and early 1998.

[14] See OECD (1997, pg. 54) for a list of various options for the funding of tertiary institutions.

[15] The preceding analysis contains an interesting parallel to Beristáin's (1991) analysis of options to meet the rapidly increasing demand for higher education foreseen in Mexico for the 1990s. In his analysis, the demand for higher education emerges from exogenous demographic pressures. In this paper, the increased demand results from exogenous increases in the dispersion of wages observed in

Looking toward the future, there are two developments that bode well for the distribution of income in Mexico in future years. One is that Mexico has gotten past "Ram's turning point" (section B), so that further advances in the average schooling level should result in a more even distribution of education across the labor force. Other things being equal, that should translate into a more equal distribution of earnings. The other development is that the supply of workers with higher education is increasing, which is the desired market response to the increased wage premium on higher education. The increasing supply of more educated workers should eventually reduce the wage premium received by such workers and, thus, also tend to equalize the earnings distribution. In view of the long gestation periods associated with investments in education, however, the income-equalizing dynamics in both cases operate with a long-term horizon. Any reallocations in education expenditures, therefore, should be made with that horizon in mind and not be seen as substitutes for income transfers designed to compensate for current income inequalities.

F. Summary

This chapter arrived at six principal conclusions and one recommendation:

- The accumulation of human capital, as proxied by education attainment, does not appear to be among the factors responsible for Mexico's disappointing growth performance since the early 1980s, but rather stands out positively in historical and international comparisons.

- Mexico experienced a pronounced increase in earnings inequality during the period 1984-94, in spite of a rapid expansion of education attainment levels that exerted an equalizing impact on earnings. Of the various hypotheses that have been advanced to explain the increased earnings inequality in Mexico as well as other developing and developed countries, the most persuasive appears to be that it is caused by an increased rate of skill-biased technological change, whose transmission to developing countries may have been facilitated by the increased openness of those economies.

- The increased earnings inequality is associated closely with a higher dispersion of the average wages received by workers with different schooling attainment. This had the consequence, in turn, of raising the private rates of return to higher levels of education; in effect reversing the traditional pattern of rates of return, where the highest rates are reported for the primary level. The social rates of return also exhibit this reversal in the relative magnitude of the rates of return. In contrast to the

---

Mexico and other countries. Among the response options outlined by Beristáin, the first is to maintain the status quo, which mainly involves the provision of services by public universities on a cost-free basis. The second option is to charge an increasing share of education costs to beneficiaries, while keeping the provision of service in public hands. The third option goes one step further by transferring an increasing portion of the provision of services to private hands. He concludes that Mexico's fiscal constraints and political considerations render the first option non-viable, so that increased demand for university education is best accomodated through a response that involves a combination of the second and third option. The conclusions of this paper also point in the same direction.

increased dispersion of the private rates, however, the social rates of return across different schooling levels have become more uniform in 1994, compared with 1984. This suggests that the assignment of education resources has become more efficient.

- Government spending on education rose significantly in the early 1990s. It also became more equitably distributed as per-student spending in higher education declined markedly compared to per-student spending at the primary level. Spending on education continues to be very concentrated in the public sector, especially at the federal level.

- That a more equitable distribution of public spending on education was achieved simultaneously with a more efficient spending pattern -- as reflected in the reduced dispersion of social rates of return -- is very surprising. Normally one expects a tradeoff between equity and efficiency in this context. What explains this result is that the spending pattern in the early 1980s was both highly inefficient and inequitable. So reduced spending at higher levels made for a more equitable distribution of resources, while simultaneous changes in the external environment that raised the returns on higher schooling levels, caused the allocation of resources (which continues to be biased toward higher education) to become more efficient.

- As the social rates of return are equalized, the possibilities of exploiting initial inequities and inefficiencies will become exhausted. Furthermore, there is little reason to expect the pace of technological change to abate, so that wage dispersion may well continue to increase. This will continue to raise the rates of return for higher education, warranting the shift of more resources toward higher education on the basis of efficiency considerations, which ultimately translate into productivity considerations. To the extent that resource shifts in that direction are thwarted by equity considerations, output and productivity growth will suffer.

- The recommended solution to the preceding dilemma is for the government to progressively pass on a greater share of the costs of higher education to its direct beneficiaries, while facilitating the private absorption of those costs through student loan programs designed to correct market failures in the financial sector.

Annex

Technical Note on Measuring the Rates of Return in Education

The rates of return on investments in education presented earlier are derived according to a method outlined by Chiswick (1997). It assumes that the annual earnings of a worker with schooling level s, denoted E_s, are identically equal to the annual earnings that he would have received with a year less of schooling, plus the cost of investing in one extra year of schooling, C_s, multiplied times the rate of return on that investment, r_s, or,

$$E_s = E_{s-1} + r_s C_s \equiv E_{s-1}(1 + r_s C_s / E_{s-1}) = E_{s-1}(1 + r_s K_s),$$

$$= E_0 \prod_{t=1}^{s} (1 + r_t K_t),$$

where K_t represents the cost of investing in schooling level t relative to a full year's potential earnings if investments were not made in that level of schooling. Taking the natural logarithm of both sides of this equation, the relation between earnings and schooling can then be stated as:

$$\text{A.1)} \quad Ln(E_s) = Ln(E_o) + \sum_{t=1}^{s} Ln(1 + r_t K_t).$$

The assumptions that r_t and K_t do not vary with years of schooling, together with the approximation rule for logarithms, give rise to the following "Mincerian" specification of the earnings function that can be estimated:

$$\text{A.2)} \quad Ln(E_s) = Ln(E_o) + (rK)S.$$

The estimated equations based on this "Mincerian" specification, including a separate variable representing years of labor market experience, are shown in Table A1. [16] The corresponding rates of return derived from these estimated coefficients were presented in Table 5 under the assumption that K is equal to 1. Also, since the rate of return is assumed to be the same for all levels of schooling in this case, the marginal rate of return from an additional year of schooling is the same as the average return.

Table A1: Estimated Mincerian Earnings Functions

[16] The inclusion of labor market experience, using a quadratic specification, has become a standard procedure in the estimation of human capital earnings function ever since Jacob Mincer showed in 1974 that its exclusion yields biased estimates of the schooling variable coefficients.

Dependent variable = Ln(hourly income)

Independent Variables	Wage Earners 1984		Wage Earners 1994		Monetary Income Recipients 1984		Monetary Income Recipients 1994	
	coeff	std.error	coeff	std.error	coeff	std.	coeff	std.error
Constant	-0.437	0.042	-0.676	0.026	Error		-0.233	0.027
Experience	0.070	0.003	0.062	0.002	-0.307	0.041	0.060	0.001
Experience^2	-0.001	0.000	-0.001	0.000	0.065	0.002	-0.001	0.000
Schooling	0.152	0.003	0.167	0.002	-0.001	0.000	0.172	0.002
					0.146	0.003		
R-square	0.35		0.38		0.27		0.33	
Adj R-sq.	0.35		0.38		0.27		0.33	
No. observ.	4,864		12,99[illegible]		7,555		22,269	

Source: Estimated with data from ENIGH84 and ENIGH94

The "extended" version of the earnings function is derived by assuming that r_t and K_t vary across the four education categories stated in Table A2:

- Category 1 refers to having completed the primary education level (which comprises 6 years) and may include some attendance at the secondary level,
- Category 2 refers to having completed the secondary level (comprising an additional 3 years), and may include some attendance at the preparatory level,
- Category 3 refers to having completed the preparatory level (3 years), and may include some university attendance, and
- Category 4 refers to having completed the university level (4 years) and any additional post-graduate education.

Table A2: Estimated Extended Earnings Functions
(Dependent variable = Ln(hourly income)

Independent variables	Wage Earners 1984		Wage Earners 1994		Monetary Income Recipients 1984		Monetary Income Recipients 1994	
	coeff	std.error	coeff	std. error	coeff	std.error	coeff	std.error
Constant	-0.108	0.040	-0.214	0.026	0.038	0.039	-0.233	0.027
Experience	0.070	0.003	0.062	0.002	0.065	0.002	0.060	0.002
Experience^2	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001	0.000
Dummy Variables								
Primary complete	0.674	0.030	0.553	0.021	0.586	0.028	0.606	0.021
Secondary complete	1.088	0.036	1.043	0.023	1.016	0.036	1.104	0.024
Preparatory complete	1.644	0.046	1.704	0.027	1.546	0.047	1.779	0.030
University complete	1.979	0.057	2.362	0.032	1.946	0.057	2.453	0.035
R-square	0.34		0.37		0.26		0.32	
Adj. R-sq.	0.34		0.37		0.26		0.32	
No. Observations	4864		13,991		7,555		22,269	

Source: Estimated with data from ENIGH84 and ENIGH94

Using these schooling category distinctions, the extended earnings function is derived from expression (A.2) as:

$$\text{A.3)} \quad \begin{aligned} Ln(E_s) = Ln(E_o) &+ (r_1 K_1)S_1 \\ &+ (r_2 K_2)(S_1 + S_2) \\ &+ (r_3 K_3)(S_1 + S_2 + S_3) \\ &+ (r_4 K_4)(S_1 + S_2 + S_3 + S_4), \end{aligned}$$

$$= Ln(E_o) + b_1D_1 + b_2D_2 + b_3D_3 + b_4D_4 ,$$

where the b_i 's refer to the coefficient estimates in Table A2 associated with each Dummy variable, D_i , and the S_i 's refer to the number of years needed for moving from schooling level i-1 to level i. The estimation of this earnings functions using Dummy variables (such that each individual is only associated with a single Dummy =1)[17], yields the coefficients presented in Table A2. To derive the average rates of return from these coefficients, it is first necessary to deflate them by the corresponding S's and K's shown in the equation above. [For example, $r_1 = b_1/(K_1S_1)$.]

Table A3 presents the cumulative number of years in school used for each schooling category to derive the r_i's according to the preceding formula. These figures do not take into account repetition rates, which break the one-to-one correspondence between years spent in school versus schooling level attained. Instead, Table A3 assumes that persons who reported having completed a particular schooling level spent the minimum time needed to attain that level, while persons who did not complete a certain level were assigned a schooling time that is half-way between having completed the previous level without repetition and completing the next level.[18]

Table A3: Assumed Average Years of Schooling

	Wage Earners		Monet. Inc. Recip.	
School Attainment Levels	**1984**	**1994**	**1984**	**1994**
0 - Less than Primary complete	2.21	2.07	2.21	1.93
1 – Primary and some Secondary	6.21	6.20	6.21	6.18
2 – Secondary and some Preparatory	9.18	9.14	9.18	9.29
3 – Preparatory and some University	12.76	12.78	12.85	12.80
4 – University complete and above	16.03	16.08	16.03	16.08

Note: It is assumed that completion of primary, secondary, preparatory and university levels takes 6, 9, 12 and 16 years.

[17] An alternative procedure would have been to assign dummy variables for each level of education completed, such that some individuals will have a positive Dummy assigned to them more than once. A person whose maximum attainment is the preparatory level, for example, would count as positive in three Dummy variables (primary, secondary, preparatory) under that procedure, while under the present procedure he only counts positive once, in D_3.

[18] The procedure was chosen for lack of conveniently available data for making the requisite adjustments, in full recognition that it may result in important biases that overestimate the true rates of return (see Behrman and Deolalikar, 1991). One extenuating circumstance in favor of this procedure is that the focus of this report is mainly on the change in the rates of return of education over time, rather than on their absolute value. Although this too will yield biases so long as repetition and drop-out rates do not remain constant over time, the impact will not be as strong.

The rates of return (the r_i 's) in equation (A.3) represent <u>average</u> rates of return to education over the entire period that it takes to reach a certain schooling level. The <u>marginal</u> rate of return (denoted as m_i) obtained by moving from one level of schooling to the next, however, can be easily derived by expressing the average rate as the weighted sum of marginal rates. For example, the dummy coefficient for having at least completed the secondary level, $b_2 = (r_2 K_2)(S_1 + S_2) = (r_1 K_1)S_1 + (m_2 K_2)S_2 = b_1 + (m_2 K_2)S_2$, so that the unadjusted marginal return for investing in secondary education is $m_2 K_2 = (b_2 - b_1)/S_2$. The private and social rates of return to education are derived from these unadjusted marginal rates by dividing through with the appropriate K_i. The appropriate K for each level i can be expressed as:

A.4) Private K $= K_i^p = (xE_{i-1} + C_i^p)/E_{i-1}$

A.5) Social K $= K_i^S = (xE_{i-1} + C_i^p + C_i^g)/E_{i-1} = K_i^p + (C_i^g / E_{i-1})$.

In the above notation, the private cost of education is composed of C_i^p, which denotes an individual's private out-of-pocket expenses associated with one year of schooling to reach schooling level i, and of xE_{i-1}, which denotes the level of earnings foregone by a student with schooling level i-1 that is studying to reach schooling level i. The variable x ranges between 0 and 1, and measures the extent to which a student is able to work part-time while attending school (in inverse fashion). A standard convention in previous work is that if a student has full-time employment, he does not forego any earnings and x = 0. This convention, however, fails to recognize the private cost in terms of foregone leisure. Finally, the social cost of education consists of the private costs plus C_i^g, which denotes the government's expenses per year to advance one student to level i.

<u>Private Rates of Return</u>. Table 5 earlier presented the private marginal rates of return derived under the assumption that the private K's (equation A.4) are equal to 1 for all education levels. This assumption is based on two considerations: first, it assumes that students on average value their leisure at the same rate as the wage foregone by studying. That means that if a student works while going to school he is giving up an amount of leisure that is worth the same as the amount of earnings given up by a student who decides not to work while going to school. The second assumption is that out-of-pocket private expenses of going to school are negligible, as suggested by Figure 3, which shows that the overwhelming share of direct expenditures on education is accounted for by the federal government. (This assumption is reviewed further below.)

<u>Social Rates of Return</u>. The social rates of return to education are obtained by taking into account the total cost of the investment associated with moving an individual from one education category to the next, independent of whether these costs are borne by the individual or the government. As derived here, they do not contemplate any externalities that might be associated with different levels of education. Table 6 reported the social marginal rates of return to education. They were derived by dividing the private rates in Table 5 by the social K's shown in equation (A.5), again under the assumption that the private K's are equal to one. (The public cost ratio, C_i^g/E_{i-1}, was obtained for different schooling levels from the information contained in Tables 2 and 3.) Note that as long as the the private individual does not bear all the costs involved with education (i.e.,

$C_i^g / E_{i-1} > 0$), the social rates of return will by construction always be lower than the private rates of return, which is borne out in a comparison of Tables 5 and Table 6.

Estimated Private Costs of Schooling in 1994

The information in Figure 3 was taken from official reports that may have underestimated the total private out-of-pocket costs associated with investments in education. This Annex provides a separate estimate of private costs of schooling using the income-expenditure survey of 1994. ENIGH94 provides information on direct outlays associated with schooling by level (pre-primary, primary, secondary, preparatory and university) in each family, together with spending on schooling articles that is not broken down by level. In Annex Table A4, these last costs are divided up across different schooling levels in proportion to the direct outlays. The resulting total of private expenditures on education is then divided by an estimate of the number of students attending at each level. According to these figures, private spending accounted for about 27 percent of total spending on education in 1994. These private costs of education are still fairly modest in terms of average earnings, but turn out to be significant when compared to the earnings of workers without experience, which may be a more appropriate comparison for a student deciding whether to continue his studies to a certain level or begin working without completing his degree.

Annex Table A4: Private Spending on Education in Mexico, 1994

	Private Expenditures Per Student (1994 Pesos)	As share of annual earnings of workers with prior level of schooling attainment: Ave. 1994 Earnings W& S	Monet. Inc.	Workers w/o experience W&S	Monet. Inc.
Primary	617.2	8.0%	7.4%	26.8%	29.8%
Secondary	1081.6	9.6%	8.2%	28.0%	27.6%
Preparatory	1625.6	11.5%	10.2%	27.1%	26.0%
University	3,369.4	13.1%	12.1%	31.0%	29.1%
average	*1047.0*	*6.3%*	*6.2%*	--	--
	Total Students in sample	Non-working (%)		Working (%)	Ave. hrs/week
Primary	8131	97.6%		2.4%	43.0
Secondary	3374	91.3%		8.7%	31.3
Preparatory	1940	82.8%		17.2%	34.6
University	970	70.8%		29.2%	36.7
Total	*14415*	*92.3%*		*7.7%*	*36.5*

Source: Own calculations from ENIGH94. To calculate the spending shares, average 1994 Earnings are from Table 2 and the earnings of workers without experience are calculated from the earnings function coefficients in Table A2.

The lower half of Annex Table A4, shows the proportion of students that work, at least part-time, while going to school. The overall low figure of 7.7 percent is strongly influenced by the primary level average, which comprises more than half of all students included in the survey. As we move up the schooling levels, part -time

employment becomes much more significant. At the highest level, an estimated 29.2 percent of all students attending university are working an average of 36.7 hours per week. Although these figures are often used to calculate the total private opportunity cost of going to school, this paper ignores that approach on the assumption that the earnings from part-time work are offset by the loss of leisure of equal value.

Annex Table A5 presents the private and social rates of return for wage earners after taking into account the private costs of education suggested above. Instead of being equated to one, the 'private K' from equation (A.4) is now equal to 1 plus the ratio of the private outlays per student from Table A5, divided by the average income of persons with schooling levels one category below the one being aspired to by the student. (Furthermore, it is assumed that the resulting ratio applies also in 1984.) The private rate of return is then obtained by dividing the rates in Table 5 by this new private K, and similarly, the social rates of return are derived by revising the values for the 'social K' with these revised private K's. The results in Table A5 indicate that the basic conclusions derived earlier about the tendency toward a reduced dispersion of social rates of return in 1994 do not change substantially with these revisions.

Annex Table A5: Revised Private and Public Rates of Return to Education

Schooling level	Based on average foregone earnings; Table 2		Based on foregone earnings of workers with no experience; estimates from Table A2.	
	1984	**1994**	**1984**	**1994**
Private Rates				
1- primary	15.6%	12.8%	13.3%	10.9%
2- secondary	12.7%	15.2%	10.9%	13.0%
3- preparatory	13.9%	16.3%	12.2%	14.3%
4- university	9.1%	17.6%	7.9%	15.2%
Social Rates				
1- primary	14.4%	10.5%	10.8%	6.5%
2- secondary	11.3%	12.2%	8.1%	8.0%
3- preparatory	11.7%	12.2%	8.7%	8.7%
4- university	7.0%	12.1%	5.4%	8.1%

The Effects of Higher Wage Dispersion on the Returns to Education

Exogenous changes in the dispersion of wages alter the private rates of return to education. In the absence of any policy responses, they will also change the social rates of return in the same proportion. To see this, note from expressions (A.4) and (A.5), that the social rate of return of investing in education level i can be expressed as a function of the private rates of return:

$$m_i \equiv r_i^P K_i^P = r_i^S K_i^S = r_i^S [K_i^P + (C_i^g / E_{i-1})].$$

After dividing through by K_i^P, this yields:

$$m_i/K_i^p \equiv r_i^p = r_i^S [\, 1 + (C_i^g / E_{i-1})/K_i^p \,] = r_i^S [1 + G_i],$$

where G_i is a positive function of the amount of government spending per student in level i of education. For simplicity's sake, assume that K_i^p remains constant over time.[19] Then by taking logs and differentiating, we obtain that,

A.6) $$dm_i/m_i \equiv dr_i^p/ r_i^p = d r_i^S/ r_i^S + dG_i /[1 + G_i].$$

As observed earlier, over the interval from 1984 to 1994, the real wages of persons with university education increased proportionately much more than the real wages of workers with primary and secondary education. This means that the private rates of return for higher levels of education would increase by more than for the lower levels; or using the notation in expression (A.6), $dr_i^p/ r_i^p > dr_{i-1}^p/ r_{i-1}^p$. If the government were not to change its resource allocation across the different education levels (i.e., $dG_i = 0$), then the social rates of return would also adjust by the same proportion and in the same direction as the change in private rates of return.

Alternatively, assume that the government were applying a policy rule to maintain the social rates of return constant across education levels (the efficient rule discussed earlier). That would mean that dG_i would have to adjust in the same proportion as the change in private rates of return. In Mexico's case, the increase in the rate of return to higher education would have to be met with an increase of G in higher education, while the decline in the rate of return to primary education would have to be met with a reduction of G at the primary level. Only that way will the social rates of return be maintained equal in the face of diverging movements in the private rates of return. Such a policy response in G, however, also tends to exacerbate income inequalities, at least in the short run, for the reasons discussed in Section E.

Annex Table A6:
Revealed Response to Change in Private Rates of Return, 1984-1994

	Wages & Salaries			**Monetary Income**		
	Proportional change in:			*proportional change in:*		
Schooling level	private R	social R	G	private R	social R	G
1 - primary complete	-18.3%	-27.1%	8.8%	-2.7%	-13.9%	
2 – secondary complete	20.1%	4.8%	15.3%	11.2%		
3 – preparatory complete	17.4%	2.3%	15.1%	10.3%	-3.1%	13.4%
4 – university and above	76.7%	73.7%	3.0%	33.3%	18.0%	15.0%
				60.9%	44.8%	16.1%

Source: Calculated from Tables 5 and Table 6.

Table A6 shows the actual response that took place in Mexico: even though the private rates of return moved in divergent directions -- rates on primary education declined, while rates on higher levels increased -- Government spending

[19] This assumption is less heroic than might appear, since it merely implies that the share of a full year's income that would be foregone by continuing to study [i.e., variable x in expression (3.4)] remains constant and that private out of pocket expenses move in line with earnings over time.

increased at all levels, indicating that the "efficient" expenditure adjustment rule was not followed. This apparent "egalitarian" response is consistent with the earlier observation in Table 4, that per capita federal spending on different schooling levels had become more equal in recent years. The unfortunate consequence of an egalitarian response is that relatively fewer resources become invested in the education levels with the highest rates of return, which eventually becomes translated into lower productivity growth.

REFERENCES

Behrman, Jere R. and Anil B. Deolalikar, 1991, "School Repetition, Dropouts, and the Rates of Return to Schooling: The Case of Indonesia", Oxford Bulletin of Economics and Statistics, 53, 4, pp. 467-80.

Beristáin, Javier, 1991, "Tres Opciones de Política de Atención a la Demanda de Educación Superior", in Francisco Gil Díaz and Arturo M. Fernández, editors, El Efecto de la Regulación en Algunos Sectores de la Economía Mexicana, Fondo de Cultura Económica, Mexico.

Bosworth, Barry, 1997, "Productivity Growth in Mexico", background paper for the World Bank CEM on Mexico: Enhancing Factor Productivity Growth.

Chiswick, Barry R. 1997, "Interpreting the Coefficient of Schooling in the Human Capital Earnings Function", Policy Research Working Paper No. 1790, The World Bank.

Cragg, Michael and Mario Epelbaum, 1994, "The Premium for Skills: Evidence from Mexico", mimeo, (November).

De la Torre, Rodolfo, 1997, "Desigualdad, Pobreza y Polarización Social en México", processed.

Elias, Victor J., 1992, Sources of Growth: A Study of Seven Latin American Economies, International Center for Economic Growth.

Feenstra, Robert C. and Gordon H. Hanson, 1996, "Globalization, Outsourcing, and Wage Inequality", AEA Papers and Proceedings, Vol. 86, No. 2 (May), pp. 240-45.

Hernandez Laos, Enrique, Nora Garro Bordonaro and Ignacio Llamas Huitrón, 1998, "Productividad y Mercado de Trabajo en México", background paper for the World Bank CEM on Mexico: Enhancing Factor Productivity Growth.

Johnson, George E., 1997, "Changes in Earnings Inequality: The Role of Demand Shifts", Journal of Economic Perspectives, Vol. 11, No. 2 (Spring), pp. 41-54.

Katz, Lawrence F. and Kevin M. Murphy, 1992, "Changes in Relative Wages, 1963-1987: Supply and Demand Factors", Quarterly Journal of Economics, (February).

Londoño, Juan Luis, 1996, "Poverty, Inequality and Human Capital Development in Latin America, 1950-2025", World Bank Latin American and Caribbean Studies, (June).

Organization for Economic Cooperation and Development (OECD), 1997, Education at a Glance: OECD Indicators, Paris.

Pánuco-Laguette, Humberto and Miguel Székely, 1996, "Income Distribution and Poverty in Mexico", in Victor Bulmer-Thomas, editor, The New Economic Model in Latin

America and its Impact on Income Distribution and Poverty, St. Martin's Press, New York, pp. 185-222.

Psacharopoulos, George, 1994a, "Returns to Investment in Education: A Global Update", World Development, Vol. 22, No. 9 (September).

Psacharopoulos, George and Y.C. Ng, 1994b, "Earnings and Education in Latin America: Assessing Priorities for Schooling Investment", Education Economics, Vol. 2, No. 2.

Psacharopoulos, George, Eduardo Velez, Alex Panagides and Hongyu Yang, 1996, "Returns to Education During Economic Boom and Recession: Mexico 1984, 1989 and 1992", Education Economics, Vol. 4, No. 3.

Ram, Rati, 1990, "Educational Expansion and Schooling Inequality: International Evidence and Some Implications", The Review of Economics and Statistics.

Robbins, Donald, 1994, "Earnings Dispersion in Chile After Trade Liberalization", mimeo, Northeast Universities Development Conference, Economic Growth Center, Yale University (October).

Schultz, T. Paul, 1988, "Education Investments and Returns", in H. Chenery and T.N. Srinivasan, editors, Handbook of Development Economics, vol. I, Elsevier Science Publishers B.V., pp. 543-629.

Journal of Economic Perspectives, 1997, "Symposium on Wage Inequality", Vol. 11, No. 2 (Spring).

World Bank Economic Review, 1997, "Symposium Issue on How International Exchange, Technology, and Institutions Affect Workers", Vol. 11, No. 1 (January).

Presidencia de la Republica, Estados Unidos Mexicanos, Primer Informe de Gobierno, 1989.

Presidencia de la Republica, Estados Unidos Mexicanos, Tercer Informe de Gobierno, 1997.